Exotic Animals

Project title: The Invasiveness and Impact of the Exotic New Zealand Mudsnail

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Objective: To 1) assess the invasion potential of New Zealand mudsnails by measuring their performance under ambient conditions; 2) estimate secondary production by developing a model of growth and reproduction under different ambient conditions; and 3) study the impact of mudsnails on native snails.

Findings: In the past year, my students and I have been assessing the invasion potential of mudsnails by measuring their survivorship, growth rates, and reproduction rates in both field and lab studies. In the lab this year, we raised snails from the Madison River at 12, 18, and 24 degrees C. In brief, we found that the age of first reproduction exceeds 6 months at 12 degrees. Mudsnails reproduced at 12 and 18 degrees C, but failed to produce any eggs or juveniles at 24 degrees C.

In the field, I measured growth and reproduction in three different seasons. We (Bob Hall collaborator) measured growth and reproductive rates in the Madison, Gibbon, Firehole, and Snake rivers over a two week period in July, and these measurements will be used in the model of secondary production.

I also measured growth and reproduction over a several month period at "invasion fronts" that have been identified on tributaries of the Firehole and Gibbon rivers (6 sites). These studies were conducted between September 1999 and March 2000 (3 sites), and between July 2000 and November 2000 (3 sites). I found that snails were able to grow and reproduce at sites above their current summer distributions.

The temperature regime during all of these experiments was measured using data loggers (a total of 9), which continue to monitor water temperatures. My graduate student and I established preliminary experiments to examine competition between mudsnails and native snails, and the impact of mudsnails on periphyton density. We have conducted two experiments so far (Fall 1999 and Summer 2000), both using *Physa gyrina.* Data analysis is currently underway. Samples are currently housed at Ohio University.

Project title: Linking Modeled and Experimental Interaction Strength Between Exotic New Zealand Mudsnails and Algae

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Additional investigator(s): Mark Dybdahl, Billie Kerans

Objective: The objective is to estimate interaction strength between exotic mudsnails and periphyton by using a modeling approach and to test these estimates by using controlled field experiments. This approach will allow us to estimate impact of New Zealand mudsnails on river algae.

Findings: Using bioenergetics approaches we estimated consumption rates of algal biomass by snails in small experimental chambers in the Firehole River and Snake River in Yellowstone. We also manipulated snail densities in chambers to estimate impact to algae biomass and production over a one-week interval. In both rivers snails strongly impacted algae, as algal biomass was negatively linearly related to snail biomass. Predicted interaction strength positively related to theoretically modeled interaction strength. However, modeled interaction strength was higher than measured, likely because of high turnover of algal biomass. Growth rates of algae (i.e., production:biomass) were slower with increasing snail biomass, suggesting that snails were consuming high-turnover algal taxa. Consumption rates were negatively related to algal production rates, and algae consumption by snails consumed up to 100 percent of algae production. Given snail biomass near 25 g AFDM/m2 in the Firehole River, we suggest that these invaders are decreasing whole-stream algal production. We will reexamine these relationships this upcoming summer in the Snake and Firehole rivers.

Project title: Food Web Impacts of Exotic New Zealand Mudsnails in Yellowstone National Park

Principal investigator: Dr. Robert Hall
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Additional investigator(s): Mark Dybdahl, Billie Kerans

Objective: Estimate carbon flow in food webs of rivers with high (Firehole River) and low (Gibbon River) densities of exotic snails.

Findings: We are halfway through fieldwork of this study, which started field collection in August 2000. We are estimating secondary production of mudsnails and native invertebrates from two sites within the Firehole River and one site in the Gibbon River. Preliminary results show extremely high densities of snails in the Firehole River during summer and early fall (up to 400,000 / square meter), but these densities decrease during winter months. Vegetated habitat in the Firehole River has higher snail densities than riffle habitat. The Gibbon River has many fewer mudsnails than the Firehole River. We will complete field sampling September 2001 and data analyses by January 2002.

Project title: Gypsy Moth Detection Trapping

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Objective: Detect the spread of gypsy moths.

Findings: Seventy one pheremone traps designed to attract and detect gypsy moths *(Porthetria dispar)* were placed in Yellowstone National Park in 2000. Traps were placed at all major developments, campgrounds, major attractions, and at pre-determined locations along park roads. No moths were detected in Yellowstone in 2000.